Axle Load Distribution for Mechanistic-Empirical Pavement Design in Sri Lanka

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Abstract

The AASHTO Mechanistic-Empirical (ME) method of pavement design seeks to combine physical causes such as stresses, strains, and deflections within a pavement structure and empirical mathematical models. The pavement responses under the ME method are computed using detailed traffic loading, material properties, and environmental data and are used to predict incremental damage over time. The design of pavements under the ME method is an iterative process using analysis results based on trial designs postulated by the designer. The basic advantage of the combined ME method over a purely empirical method is the ability to accurately characterize in-situ material. Hence it can be used for both existing pavement rehabilitation and new pavement construction, and also, the ME method accommodates changing load types and allows the designers to optimize the pavement designs. However, in Sri Lanka, the design references frequently used for local road designing purposes are the Overseas Road Note 31 and AASHTO method, which do not allow the designers to utilize the in-situ material characteristics in the design process in order to utilize the readily available materials effectively. Therefore, in most scenarios, the economy of road construction is affected detrimentally. Therefore attempting to adopt the ME design method in Sri Lanka is worthwhile investigating. For the pavement design using the ME method, the axle load spectrum data is required. In general, traffic volume is more convenient to obtain than load spectrum, considering the time and resource consumption in gathering data. The historical traffic counts and vehicle classifications are more likely to be available on many existing routes. However, for a new route, historical traffic data may not exist at all. Under these circumstances, it is necessary to estimate load spectra based on indirect information. Therefore, there is a need to develop default or representative axle load spectra that can be used with some level of confidence in the design process. Therefore, this research is aimed at deriving region-specific axle load spectra that will allow the generation of more appropriate inputs for pavement designs from the ME method. This study uses hierarchical clustering methodology and Euclidean distance matrix to identify geographical zones having similar characteristics in axle load frequency distributions. For single axle/ single tires axle loads, three geographical zones and for single axle/dual tires axle loads, four geographical zones have been identified for having similar characteristics in axle load frequency distributions. The axle load zones derived in this research will allow the estimation of traffic input to the ME pavement design approach from limited site-specific traffic data and will support the implementation of the ME design method in Sri Lanka.

Key Words: *Mechanistic-Empirical Pavement Design, Axle Load Distribution, Traffic Load Zoning Design*

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